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ENHANCED QUALITY AND EFFICIENCY IN MOBILE CRANE MANUFACTURE

To ensure their machine capability, Liebherr deploys the test stand cerTest – mobile test system for torque tools by Kistler

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Well before you reach the factory gates, you can see them towering in the distance: the booms of the huge mobile cranes that undergo the most rigorous testing here on the test site at Ehingen, Swabia (Germany) before they are delivered to every corner of the world. These cranes are built by Liebherr, the global corporation now managed by the third generation of the same family. To meet its own high standards, Liebherr opts for the cerTest mobile test system from Kistler for all power tools in use on its production lines. With the help of this system, power tools are tested regularly to ensure that they deliver consistently high quality throughout their lifetimes – and cerTest also includes end-to-end documentation of all simulated fastening scenarios.

Fastening the slewing ring on the Liebherr LTM 1160-5.2, nutrunner: Atlas Copco ETDS9-2000-38-CTADS

Starting out from its core business in the construction machines segment, Liebherr has expanded into business fields such as transportation and traffic technology, mechanical engineering and domestic appliances in recent years, and it has even opened its own hotel chain. With sales approaching EUR 10 billion and over 43 000 employees in 2017, there can be no doubt that Liebherr numbers among the global players in the sector. The entire mobile cranes business is focused here at the company's Ehingen site. All Liebherr's mobile cranes, in all their different versions, are built here: ranging from all-terrain vehicles with telescopic booms (offering both on-road and off-road capability) to crawler cranes with lattice booms. The largest crawler crane in Liebherr's range, the LR 13000, was recently deployed in Mexico for the construction of a refinery. This machine can lift weights of up to 3 000 tonnes.

Thomas Nüssle, Head of Plant Planning at the Ehingen site, outlines some of this facility's special features: "We manufacture complete vehicles here on four lines – an average of about eight vehicles every day, all of them built to order and just-in-time. Before delivery, they undergo extensive testing on our test sites: we have one for mobile cranes and another for crawlers." Marco Kassner, Foreman in the Operational Mechanics Department, adds: "Quality has top priority in our book. Throughout the world, Liebherr is appreciated for its outstanding products. And to make sure that this remains so, we work continuously on improving our processes in every area, including fastening technology."

Inhouse testing cuts costs and builds up know-how

Many different torque tools are used in the manufacture of mobile cranes. To ensure their machine capability, Liebherr deploys the cerTest mobile test system by Kistler. Thanks to cerTest, all the facility's power tools can be tested regularly on site; all the results are documented precisely, with torque and rotation angle control. Heiko Springer, who heads this project, is a project engineer in the Plant Planning Department at Liebherr Ehingen. He explains: "We currently use 128 torque wrenches from different manufacturers, and all of them have

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Heiko Springer, Project engineer in the Plant Planning Department at Liebherr Ehingen

Testing related to fastening points on the Liebherr LTM 1450-8.1

to be tested. As of 2018, we've been carrying out our own machine capability analyses based on four test points as per VDI 2645. We also carry out tests related to fastening points" Springer continues with more detail: "We use nutrunners with different technologies for 'A', 'B' and 'C' joints – with electronic or hydraulic control, or with compressed air. Thanks to this new test stand from Kistler, we can successfully meet higher quality requirements. We base our work here on the strict standards specified by the automotive industry, which requires a machine capability index of Cm/Cmk > 1.67."

End-to-end documentation for all tools

The cerTest system has four simulators (two integrated and two external) to test power tools in the torque range from 250 to 6 000 N·m. This allows dynamic simulation of all joint hardnesses up to 6 000 N·m. And for tests related to fastening points, it delivers precise statements about the current performance of the tested power tools after 25 measurements. The simulator also rotates synchro-nously during the dynamic test. The advantage of this approach over the static method is that it allows simulation of "hard" joints (with a small angle of rotation) as well as "soft" ones (with a large angle of rotation). End-to-end documentation for all tools and the main joints creates an accurate picture of a machine's capability throughout its entire life expectancy.

Thanks to cerTest, Liebherr saves about EUR 30 000 on external testing costs each year – and as an added bonus, the company can build up its own valuable know-how on fastening technology here in house. As far as Springer is concerned, the benefits are obvious: "On the one hand, we save on costs – but that's by no means all: it's also easier to ensure the quality of our internal fastening processes. What's more, the quality is better than when tests are outsourced, because testing can take place under the conditions that are present right here on site (electronic control or compressed air fluctuations, for instance). Another point is that we're building up know-how on handling power tools. And last but not least, the logistics are more efficient: we eliminate the cost of sending the tools out and sorting them back in again. We gain extra time by testing right here on the spot." Because the Kistler test stand is mobile, all the power tools can be tested near the production lines. For this purpose, cerTest is equipped with a rechargeable battery that has a lifetime of up to 16 hours.

Convincing advantages: performance scope, specialization and service

One of the key points for Liebherr was that the tool testing system must cover the full bandwidth required. With a range of up to 6 000 N·m, the external dynamic simulator also gives Liebherr the capability of testing electrical power tools currently in use at Ehingen which operate at 4 000 N·m or more. "That was a decisive factor for us, of course, because no other provider was able to manufacture a dynamic simulator with a range of up to 6 000 N·m. Other advantages were Kistler's independence, its specialization in measurement technology, and its expertise in fastening technology – adding up to a complete package that we found highly convincing," Springer emphasizes. "Starting in early 2016, we began to focus more attention on the machine capability of power tools – and in any case, this aspect has become generally more important and will become even more critical in the future. So we're very well equipped to face those challenges thanks to the solution from Kistler."

Data from all the test procedures is stored and fully documented in the CEUS software that is integrated in cerTest. Springer comments: "There was another important point here: the data on an access point that we installed on the nutrunner test stand must be sent to a server via W-LAN. That allows everyone involved to access the test results in CEUS from their PC workstations." The Plant Planning team uses handheld scanners, making it easy to set the electrically controlled tools to a test point or a special joint at the start of the test procedure. "This prevents any operator errors that could occur with manual input of the detailed data. We benefit from accurate and reliable traceability, so we know who tested which power tool, when, and to what extent," Springer notes.

He concludes by touching on his firm's excellent working relationship with Kistler. Things were difficult at the outset, due mainly to the complexity of the subject and the sheer volume of data to be collected. But now, somewhat more than one year after the project began, he is highly satisfied with the results: "Thanks to our excellent working relationship with Kistler, we overcame all the challenges. We've now established a quality assurance process that will not only save us money in the long run, but will also offer extra security as regards product liability. And by no means least, it gives us a deeper understanding of the technology. It's highly likely that we'll be using more fastener inspection systems from Kistler in the future so that we can continue to develop our expertise. At the moment, for example, we're thinking about deploying the method known as 'joint scanning'. This involves positioning a plug-on sensor between the nutrunner and the real joint. The nutrunner test stand measures the torque and rotation angle, and stores the data for the power tool. Later on, this precise joint can be simulated dynamically for this same tool on the nutrunner test stand."

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